FILE COPY
California Forest Experiment Station

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

DEVIL'S GARDEN EXTERMINATION PROJECT

MODOC NATIONAL FOREST

PROGRESS REPORT

by

K. A. SALMAN
Agent
Bureau of Entomology

National FS Library
USDA Forest Service
MAR 24 2014
240 W Prospect Rd
Fort Collins CO 80526

Annex 1
SB
763
.C2 M6
1930
C.2

Berkeley, California
January 1931

U. S. GOVERNMENT PRINTING OFFICE: 1928 J 76133

DEVIL'S GARDEN EXTERMINATION PROJECT

MODOC NATIONAL FOREST

PROGRESS REPORT

by

K. A. SALMAN
Agent
Bureau of Entomology

Berkeley, California
January, 1931

PROGRESS REPORT
DEVIL'S GARDEN EXTERMINATION PROJECT
MODOC NATIONAL FOREST

Introduction

The Devil's Garden Project was initiated in 1928 to determine whether or not the western pine beetle could be completely exterminated in isolated blocks of timber, and to study the volume of beetles infesting an area of this type and the distances they may fly in reinfesting such an area. The plan of operation proposed at the time the original plans were drafted was to subject the area to commercial control operations for two years, this to be followed in the third year by intensive control operations in an effort to secure complete extermination of the western pine beetle. The area has now been subjected to two seasons of commercial control, and it is planned to conduct intensive control operations in the spring of 1931.

Seven cruises of the area have been made, as follows:

September, 1928
April, June, August and October, 1929
May and August, 1930

Control operations were conducted in conjunction with all except the first cruise, and a total of 66 trees, or 67% of the total number of infested trees found during the last six cruises, were treated.

Keen[1] described the general features of the area and the stand in his report of October, 1928. His report should be consulted for further information.

Isolation of the Area

There has been some discussion concerning the degree of isolation enjoyed by the area. Keen stated, "the higher level of the mountain carries about 500 acres of virgin yellow pine stand. . .Around this heavier stand is about 800 acres of lightly-timbered area. . . Extending from this area for about a mile in all directions is a very open, scattered stand of pine. . . Surrounding the mountain and extending in all directions is a pure stand of juniper, with only an occasional pine tree. From the border of the pine stand it is fully six miles to any other pine areas, and these are found only in the north, northeast and northwest sides."

---

[1]Keen, F.P. October 1928. Western Pine Beetle Extermination Experiment, Timbered Mountain Unit, Modoc National Forest; file ms.

Person mapped the pine type surrounding Timbered Mountain in 1930 and found "the distance between the northernmost trees of the extermination area and the southernmost trees of the Blue Mountain Unit to the northwest is only two miles in two different places. The yellow pine type limits for the two areas are about 3½ or 4 miles apart, but occasional trees scattered between the two areas leave only a very small gap."[2] The results of Person's cruise are shown in the one-inch-scale map attached to this report. Apparently the degree of isolation of the extermination area may not be so complete as was at first thought.

Volume of Timber Infested and Treated

The volume of timber and number of trees infested in the area since 1927, as well as the volume of timber and number of trees treated since the initiation of control work, is given in the following table:

Table I
Volume of Timber Infested and Treated
Devil's Garden Project

Year and Season	Infested		Treated	
	No. Trees	Volume	No. Trees	Volume
1927 Summer	34	44,960		
1927 Winter	31	32,850		
1928 Summer	15	15,640		
1928 Winter	45	48,480	33	34,920
1929 Summer (standing)	14	14,750	4	3,390
1929 Summer (trap trees)	4	9,930	4	9,930
1929 Winter	20	21,800	20	21,800
1930 Summer (standing)	6	4,230	2	1,460
1930 Summer (trap trees)	4	3,700	3	2,520
1930 Winter (incomplete)	6	9,530		
Totals	179	205,870	66	74,020

A graphic representation of the volume of timber infested and treated is given in Fig. 1.

When the infested volumes and numbers of trees infested are considered on the basis of insect generations there is a marked irregularity in the infestation curve. This irregularity is more marked when the infestation in trap trees is left out of consideration; but it is felt that, although the presence of the trap trees complicates the situation when tree losses are being computed, the infestation in the trap trees should be considered when computing the volume of timber infested in the extermination area.

---

[2] Person, H.L. Personnel Report for June 2, 1930.

When the infestation is considered on an annual instead of a generation basis, the curve plotted from the figures for volume of timber infested is relatively smooth and shows a decreasing infestation since 1927 very similar to the curve for the Happy Camp-Lava Bed area as reported by Person[3].

Figure 2 shows a comparison of the infestation curves of the two areas, and the following table gives the figures on which they are based:

Table II

Comparison of Volume of Timber Infested in Devil's Garden Project with Total Volume of Insect Loss on Happy Camp-Lava Bed Area

Season	Devil's Garden Proj.: Vol. B.M.	% Decrease*	H.C.-L.B. Area: Vol. M.B.M.	% Decrease*
1927	77,810	0.0	183,900	0.0
1928	64,120	17.6	134,000	27.1
1929	46,480	40.3	48,000	73.9
1930**	17,460	77.6	33,740	81.7

*When compared with 1927

**Incomplete

The above table reveals that the general decrease in losses for the Happy Camp-Lava Bed area, which may be considered an index of the natural trend for the entire region, is greater than that occurring in the Devil's Garden area, in which control work has been carried on against four broods of the western pine beetle. It appears that control work has had no effect in reducing the losses. However, it must be kept in mind that perhaps a comparison between the two areas may not be possible, as the extremely poor growing conditions of the Devil's Garden area may be responsible for an entirely different infestation cycle that may have been markedly affected by the control operations.

Bark Area Infested

The volume of timber infested on an area is not so exact an index of the insect population as is the number of square feet of bark infested. The relative importance of the different species of insects causing the timber losses may also be computed from this type of information.

Emergence Records

In conjunction with this type of data some idea of the average attack and emergence per square foot of bark should be given. The only information found in the records was taken from five 1928 winter-brood trees (L-1,8,28,29 and 30). An average emergence of 57 D.b. per square foot of bark occurred in samples from these five trees. The emergence was secured in metal cages in which had been placed the bark samples.

---

[3] Person, H.L. October 1930. Report on Insect Conditions, Happy Camp-Lava Bed Area, Modoc Nat. Forest; Ninth Annual Report. File ms.

Proportion of Bark Area Infested

Records of infested bark areas on this project are available only since the start of control operations in the spring of 1929, and records were taken of but 61 of the 99 trees infested by the beetles since the winter brood of 1928. Table III compares the bark areas infested, uninfested and abandoned in the 61 trees examined (see Page 5).

It is to be noted that at no time has the seasonal record shown less than 72.5% of the total bark area of the trees to be infested by insect broods.

Table IV (on Page 5) shows the area and the per cent of the total infested bark area attacked by the various more important species of forest insects.

Fig. 3 gives the data presented in Table IV in graphic form.

It is evident from the data given in the table that the western pine beetle is the most important single species attacking the trees and that flathead borers are second in importance. An important fact brought out by the figures is the change in the composition of the infestation, as shown by the relative importance of the insect species. In 1929-winter and 1930-summer the western pine beetle infested a much smaller proportion of the total bark area than it did in 1928-winter and 1929-summer. The flathead borers showed a marked increase in their relative importance as a part of the insect population in the infested trees examined, carrying broods of 1929-winter and 1930-summer.

Total Infestation Expressed by Bark Area

Records are available for approximately 63% of the total number of trees infested in the area subsequent to and including those infested by the winter brood of 1928. This may be considered a fair sample of the total infestation in the area, and accordingly the data given in Figure 3 are applied to the total infested timber in the area since the winter brood of 1928. This information is summarized in Table V and Fig. 4.

Table III
Comparison of Infested, Uninfested and Abandoned Bark Areas

Year and Season:	1928--W		1929--S		1929--ST		1929 S Tot.		1929--W		1930--S		1930--ST		1930-S Tot.	
No. Records	33		4		4		8		14		3		3		6	
	sq.ft:	% tot B.A.:	sq.ft:	% tot B.A.:	sq.ft:	% tot B.A.:	sq.ft:	% tot B.A.:	sq.ft	tot. % B.A.:	sq.ft:	% tot B.A.:	sq.ft:	% tot B.A.:	sq.ft:	% tot B.A.
Green Bark Area	---	0	---	0	542	25.6	542	15.2	120	2.0	---	0	---	0	---	0
Aban. "	1,216	13.5	18	0.1	421	19.9	439	12.3	556	9.4	178	17.9	221	25.1	399	21.4
Infested "	7,793	86.5	1,422	99.9	1,156	54.5	2,578	72.5	5,248	88.6	812	82.1	657	74.9	1,469	78.6
Total "	9,009	100.0	1,440	100.0	2,119	100.0	3,559	100.0	5,924	100.0	990	100.0	878	100.0	1,868	100.0

Table IV
Comparison of Bark Areas Infested by Different Species of Insects

Year and Season:	1928--W		1929--S		1929-ST		1929-S Tot.		1929--W		1930--S		1930-ST		1930-S Tot.	
No. Records	33		4		4		8		14		3		3		6	
	sq.ft:	% tot	sq.ft:	% tot	sq.ft	% tot	sq.ft:	% tot	sq.ft	tot. %	sq.ft:	% tot	sq.ft:	% tot	sq.ft:	% tot
D.brevicomis	5,329	68.7	1,018	71.7	733	63.4	1,751	67.9	2,200	41.9	372	45.9	417	63.5	789	53.7
D.monticolae	483	6.2	18	1.1	54	4.7	72	2.8	370	7.1	88	10.8	---	0	88	6.0
D.valens	13	0.1	---	0	36	3.1	36	1.4	42	0.8	---	0	---	0	---	0
Melanophila sp.	1,916	18.1	51	3.6	169	14.6	220	8.5	2,084	39.7	298	36.7	240	36.5	538	36.6
Ips emarginatus	370	4.8	276	19.5	110	9.5	386	5.0	320	6.1	---	0	---	0	---	0
" oregoni	173	2.1	59	4.1	54	4.7	113	4.4	232	4.4	54	6.6	---	0	54	3.7
Tot.Inf. B.A.	7,793	100.0	1,422	100.0	1,156	100.0	2,578	100.0	5,248	100.0	812	100.0	657	100.0	1,469	100.0

ST-summer trap trees

Table V

Computed Totals of Infested Bark Areas

Season	Aver. per Tree sq.ft.	No. Trees	Generation Tot. sq.ft.	Tot. D.b. sq.ft.	Tot. Mel. sp. sq.ft.
1928 W:	236	45	10,620	7,296	1,922
1929 S:	322	18	5,796	3,935	493
1929 W:	375	20	7,500	3,143	2,978
1930 S:	245	10	2,450	1,316	897

The information brought out in the above table and in Fig. 4 shows conclusively that the total area of infested bark has decreased considerably since the winter of 1928. A slight increase over the summer of 1929 is shown by the figures for the winter of 1929. The significant fact, however, is that the area of bark infested by the western pine beetle has consistently decreased during the time records have been taken; while the setback to the general decrease recorded for the winter of 1929 was due entirely to an increase in the bark area infested by flathead borers. The area infested by other species of forest insects remained fairly constant until the summer of 1930, when a decrease was recorded.

Summary of Data

It is impossible to arrive at any positive conclusions on the basis of the data available at the present time. However, the following points have been indicated:

1. The annual volume of infested timber in the project area has been decreasing rapidly since the start of the project;

2. The rate of decrease in the project area is slower than that recorded for untreated areas in the same general region;

3. The volume of infested timber, when considered by brood seasons (summer and winter), has shown a general trend toward a marked decrease since the initiation of control operations, although the curve is irregular;

4. The western pine beetle has decreased in relative importance while flathead borers have increased in relative importance, basing the importance of the species on the bark area infested;

5. The total area of bark infested has shown a marked but irregular decrease since the winter of 1928;

6. The area of bark infested by the western pine beetle has shown a consistent and relatively steady decrease since the winter of 1928.

Plans for Continuation of the Project

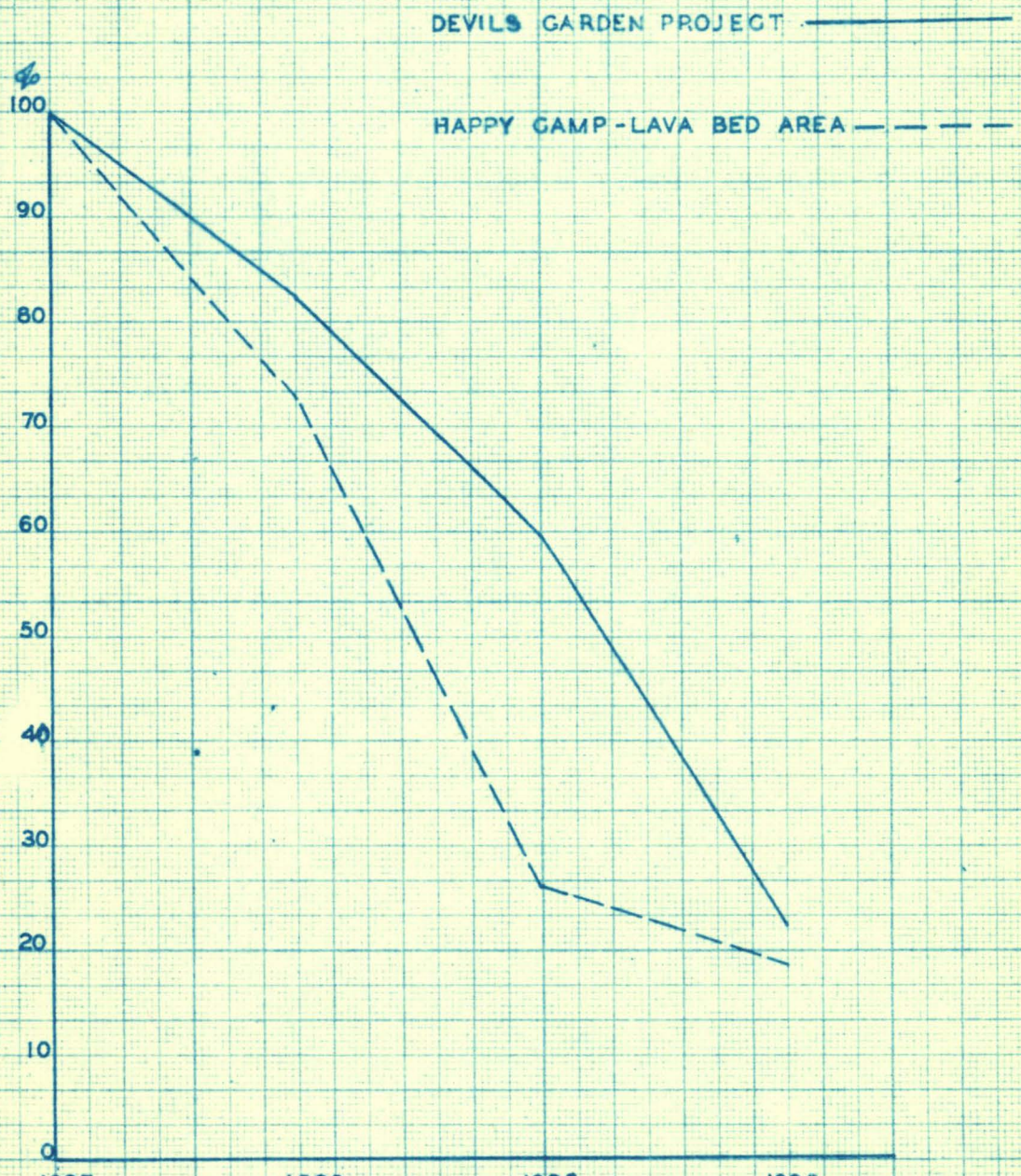
As the infestation by the western pine beetle in the project area is now at a low ebb, it is planned to make a thorough and final clean-up of the infestation in May of the coming field season (1931). A complete cruise of the yellow pine type will be made and all infested trees will be felled. Bark area infestation records will be taken and control measures applied. A sufficient number of bark samples will be taken to Berkeley for emergence records. The scattered yellow pine type surrounding the main control area will be thoroughly cruised, although by more extensive methods, and it is planned to spot all 1930 summer and winter brood trees in the area between the project unit and the surrounding pine type, and to treat the few winter brood trees that may be found. It is estimated that this work will require the services of four men for approximately two weeks, and will necessitate the hiring of two horses in order to reach those portions of the area not accessible by truck. It is estimated that the work will cost in the neighborhood of $300.

The plans for work in 1932 and subsequent seasons will depend to a large extent on the conditions found during the cruise of May, 1931.

FIGURE 2

DEVILS GARDEN PROJECT

INFESTATION CURVES 1927 - 1930



TREATED TREE DATA
PERCENT OF
BARK AREA INFESTED - BY SPECIES

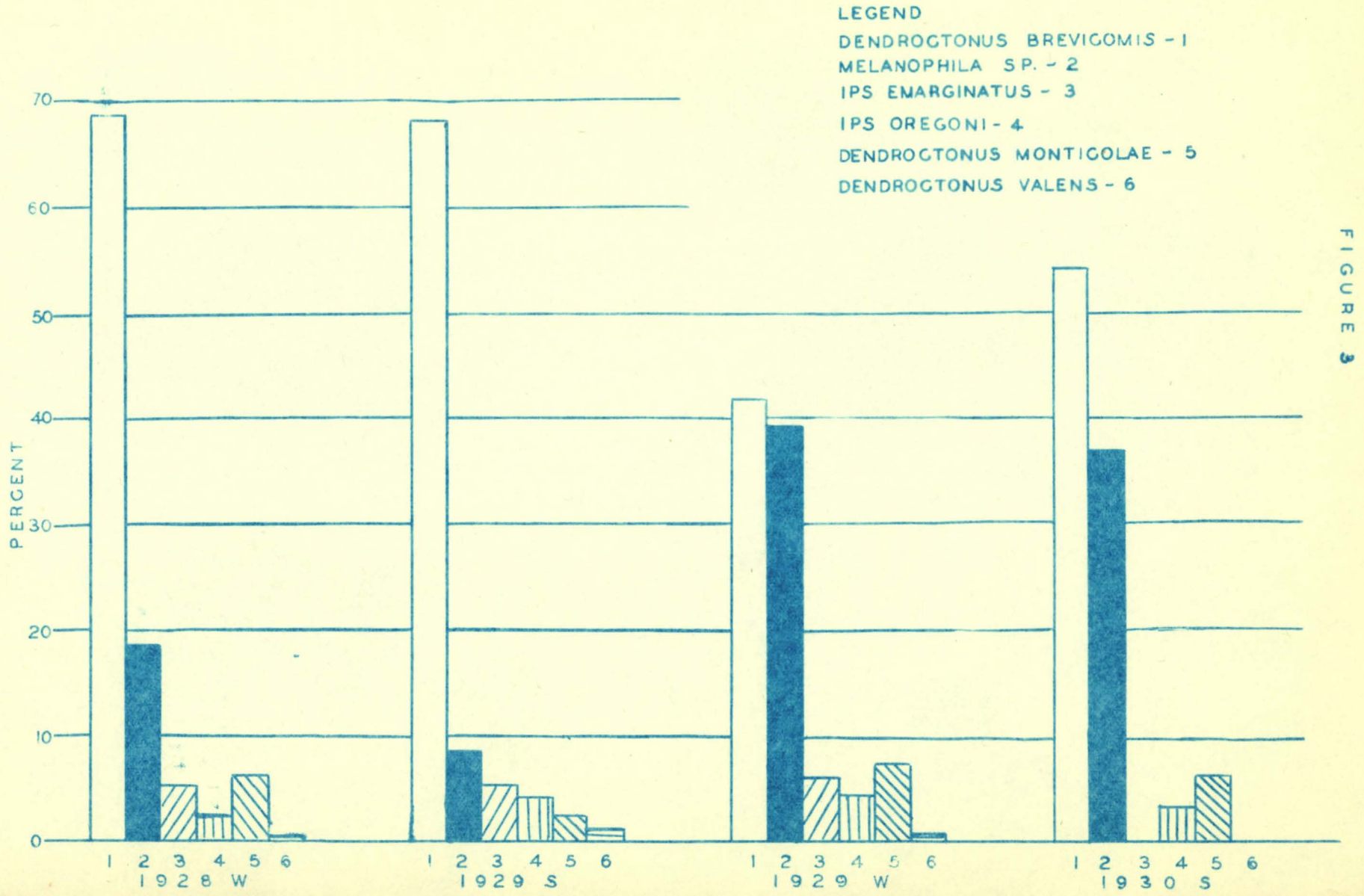
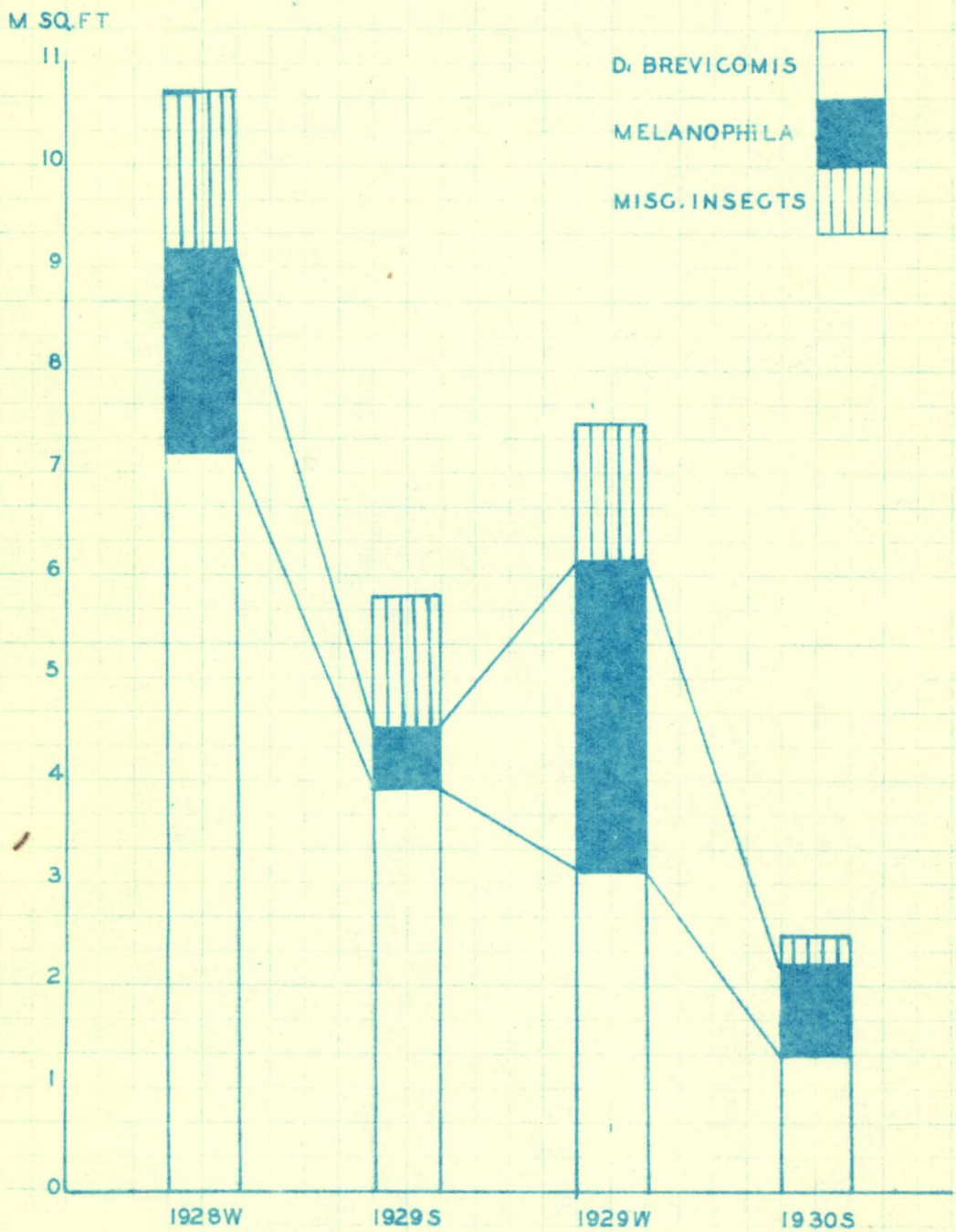


FIGURE 3

FIGURE 4

DEVILS GARDEN PROJECT

INFESTED BARK AREA DATA



BUREAU OF ENTOMOLOGY

DEVIL'S GARDEN EXPERIMENTAL AREA

MODOC NATIONAL FOREST, CALIFORNIA

SCALE: 1 INCH = 1 MILE

LEGEND

- Isolated Yellow Pine Trees
- Yellow Pine Type
- Timber Boundary

R10E R11E R12E

T46N T45N

BLUE MT. 18 ▲ LOOKOUT

HUFFMAN

Tramp Spring

Fletcher Cr.

South Spring

Small Body of Y.P.

HAGER BASIN

BOLES SPRING R.S.

Willow Creek

MAIN BODY OF Y.P.

TIMBERED MT.

28 L & M RESERVOIR

Spring

Willow Spring

Pine Spring

Cowhedd Spring